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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/605,539	10/06/2003	Tzong-Liang Tsai	UECP0001USA	2538

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NAIPO (NORTH AMERICA INTERNATIONAL PATENT OFFICE)  
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MERRIFIELD, VA 22116

EXAMINER

MAI, ANH D

ART UNIT PAPER NUMBER

2814

DATE MAILED: 05/24/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

<b>Office Action Summary</b>	<b>Application N .</b> 10/605,539	<b>Applicant(s)</b> TSAI ET AL.	
	<b>Examin r</b> Anh D. Mai	<b>Art Unit</b> 2814	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --  
**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

#### Status

- 1) ☒ Responsive to communication(s) filed on 06 October 2003.
- 2a) ☐ This action is **FINAL**.                      2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

#### Disposition of Claims

- 4) ☒ Claim(s) 1-22 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-22 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

#### Application Papers

- 9) ☒ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 06 October 2003 is/are: a) ☐ accepted or b) ☒ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

#### Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All    b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

#### Attachment(s)

- |  |   |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)  | 4) <input type="checkbox"/> Interview Summary (PTO-413)<br>Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)                                   | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152)             |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)<br>Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____  |

## **DETAILED ACTION**

### ***Drawings***

1. The drawings are objected to under 37 CFR 1.83(a). The drawings must show every feature of the invention specified in the claims. Therefore, the “p-type and n-type semiconductor layer comprise a plurality of compound layers” ; “the reflective layer is a multi-layer structure” ; “the reflective layer and the p-type and the n-type semiconductor layers contact at a rough surface, the rough surface having an incline or a curved structure” ; “the DBR layer” must be shown or the feature(s) canceled from the claim(s). No new matter should be entered.

A proposed drawing correction or corrected drawings are required in reply to the Office action to avoid abandonment of the application. The objection to the drawings will not be held in abeyance.

### ***Specification***

2. The title of the invention is not descriptive. A new title is required that is clearly indicative of the invention to which the claims are directed.

The following title is suggested:

LIGHT-EMITTING DEVICE HAVING REFLECTIVE LAYER FORMED UNDER  
THE ELECTRODES

### ***Claim Rejections - 35 USC § 112***

The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it

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pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

3. Claims 9, 16 and 21 are rejected under 35 U.S.C. 112, first paragraph, because the best mode contemplated by the inventor has not been disclosed. Evidence of concealment of the best mode is based upon the quality of applicant's disclosure is so poor as to effectively result in concealment.

At best, the specification discloses that following the formation of the semiconductor layers 42, 47, 43 and 44 on the substrate 41, etching is performed and resulted in "rough" surface.

As best understood by the examiner, the "rough" surface is an inherent result of etching of the semiconductor layers, since the "rough" surface were not formed by deposition and simply formed by etching. (See [0018]).

### ***Claim Rejections - 35 USC § 102***

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

4. Claims 1-9 are rejected under 35 U.S.C. 102(e) as being anticipated by Wang (U.S. Patent No. 6,469,324).

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With respect to claim 1, Deppe teaches a semiconductor light-emitting device (LED) as claimed including:

- a substrate (13);
- an n-type electrode (28) located on a bottom surface of the substrate (13);
- an active layer (122) located on a top surface of the substrate (13);
- a p-type semiconductor layer (16) covering the active layer (13);
- a reflective layer (180) located on the p-type semiconductor layer (124); and
- a p-type electrode (26) covering the reflective layer (180). (See Figs. 7, 10).

With respect to claim 2, the substrate (13) of Wang is a conductive material.

With respect to claim 3, the p-type semiconductor layer of Wang comprises a plurality of p-type III-V compound layers (124/14/16).

With respect to claim 4, the reflective layer (180) of Wang is a conductive layer with predetermined reflectivity, the reflective layer (180) reflects light from the active layer (122) to avoid light being absorbed by the p-type electrode (26).

With respect to claim 5, the reflective layer (180) of Wang is a single-layer structure.

With respect to claim 6, the reflective layer of Wang is a multi-layer structure (18).

With respect to claim 7, the reflective layer (180) of Wang comprises silver (Ag).

With respect to claim 8, the reflective layer (180) of Wang is a conductive layer with predetermined scattering rate, the reflective layer (180) partially reflects light from the active layer to reduce light being absorbed by the p-type electrode (26).

With respect to claim 9, the reflective layer (180) and the p-type semiconductor layer (16) of Wang contact at a rough surface, the rough surface having an incline or a curved structure with a specific reflective angle to enhance the reflective layer. (See Figs. 13, 14).

5. Claims 11, 12, 14-17, 19 and 20 are rejected under 35 U.S.C. 102(e) as being anticipated by Yoo (U.S. Pub. No. 2003/0189212).

With respect to claim 11, Yoo teaches a semiconductor light-emitting device (LED) as claimed including:

- a substrate (22);
- an n-type semiconductor layer (26) covering the substrate (22);
- an active layer (28) and an n-type electrode (40) separately covering portions of the n-type semiconductor layer (26);
- a p-type semiconductor layer (30) covering the active layer (28);
- a first reflective layer (34) located on the p-type semiconductor layer (30); and
- a p-type electrode (36) covering the first reflective layer (34). (See Fig. 1A).

With respect to claim 12, the substrate (22) of Yoo is a nonconductive material.

With respect to claim 14, the LED of Yoo further comprises a second reflective layer (38) located between the n-type semiconductor layer (26) and the n-type electrode (40).

With respect to claim 15, the first reflective layer (34) and the second reflective layer (38) of Yoo are both a conductive layer with predetermined reflectivity, the first reflective layer (34)

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and the second reflective layer (38) reflect light from the active layer (28) to avoid light being absorbed by the p-type electrode (36) and the n-type electrode (40).

With respect to claim 16, as best understood by the examiner, the second reflective layer (38) and the n-type semiconductor layer (26) inherently contact at a rough surface, the rough surface having an incline or a curved structure with a specific reflective angle to enhance the second reflective layer are the result of an etch.

With respect to claim 17, the first reflective layer (34) and the second reflective layer (38) of Yoo are both a single-layer structure.

With respect to claim 19, the first reflective layer (34) and the second reflective layer comprise gold (Au) or Platinum (Pt).

With respect to claim 20, the first reflective layer (34) and the second reflective layer (38) are both a conductive layer with predetermined scattering rate, the first reflective layer (34) and the second reflective layer (38) partially reflect light from the active layer (28) to reduce light being absorbed by the p-type electrode (36) and the n-type electrode (40).

### ***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

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6. Claim 10 is rejected under 35 U.S.C. 103(a) as being unpatentable over Wang '324 as applied to claim 1 and 4 above, and further in view of Estevez-Garcia (U.S. Patent No. 6,586,721).

With respect to claim 10, Wang teaches an LED further includes conductive reflective layer (180A) located between the substrate (13) and the active layer (122).

Thus, Wang is shown to teach all the features of the claim with the exception of using a distributed Bragg reflector (DBR).

However, Estevez-Garcia also teaches the LED (16) further includes a DBR reflective layer (21) located between the substrate (20) and the active layer (25). (See Fig. 3).

Therefore, it would have been obvious to one having ordinary skill in the art at the time of invention to form the reflective layer of Wang using a DBR type reflective layer as taught by Estevez-Garcia to reflect light from the active layer to avoid light being absorbed by the n-type electrode.

7. Claim 13 is rejected under 35 U.S.C. 103(a) as being unpatentable over Yoo '212 as applied to claim 11 above, and further in view of Rennie et al. (U.S. Patent No. 6,121,638).

Yoo teaches an LED having n-type and p-type semiconductor layers.

Thus, Yoo is shown to teach all the features of the claim with the exception of disclosing a multi-layer n-type and p-type semiconductor.

However, Rennie teaches an LED having plurality of n-type and p-type III-V compound semiconductor layers. (See Figs. 18-23).



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Therefore, it would have been obvious to one having ordinary skill in the art at the time of invention to form the LED of Yoo having plurality of n-type and p-type III-V compound semiconductor layers as taught by Rennie to improve the performance of the device.

8. Claims 18 and 21 are rejected under 35 U.S.C. 103(a) as being unpatentable over Yoo '212 as applied to claims 11 and 15 above, and further in view of Wang '324.

With respect to claim 18, Yoo teaches an LED having the first and second reflective layers.

Thus, Yoo is shown to teach all the features of the claim with the exception of both layers are formed of multi-layer structure.

However, Wang teaches an LED having both first, p-side (18) and second, n-side (18A) reflective layers are formed of multi-layer structure (180/182).

Therefore, it would have been obvious to one having ordinary skill in the art at the time of invention to form both first and second reflective layers of Yoo comprise multi-layer structure as taught by Wang minimize optical loss due to light piping and substrate absorption.

With respect to claim 21, Yoo teaches an LED having a first reflective layer (34) formed on the p-type semiconductor layer (30).

Thus, Yoo is shown to teach all the features of the claim with the exception of the first reflective layer and the p-type semiconductor layer contact at a rough surface.

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However, Wang teaches the first reflective layer (180) contacts the p-type semiconductor layer (16) at a rough surface, the rough surface having an incline or a curved structure with a specific reflective angle to enhance the first reflective layer. (See Figs. 13-14).

Therefore, it would have been obvious to one having ordinary skill in the art at the time of invention to form the first reflective layer and the p-type semiconductor layer of Yoo contacting at a rough surface as taught by Wang to maximize the light extraction.

9. Claim 22 is rejected under 35 U.S.C. 103(a) as being unpatentable over Yoo '212 as applied to claim 11 above, and further in view of Applicant Admitted Prior Art (hereinafter APA).

Yoo teaches an LED having a reflective layer on the n-type semiconductor layer.

Thus, Yoo is shown to teach all the features of the claim with the exception of further includes an DBR on the substrate.

However, APA teaches a reflective layer (22) of DBR type is formed between the substrate (21) and n-type semiconductor layer (27). (See Fig. 2).

Therefore, it would have been obvious to one having ordinary skill in the art at the time of invention to form the LED of Yoo further including a distributed Bragg reflector (DBR) between the substrate and the n-type semiconductor layer as taught by APA to avoid losing light through the substrate.


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***Conclusion***

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Anh D. Mai whose telephone number is (571) 272-1710. The examiner can normally be reached on 9:00AM-5:00PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Wael Fahmy can be reached on (571) 272-1705. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

  
A.M  
May 18, 2004